Report on Video Display Terminals

A report prepared for the
Occupational Health and Safety Council
by the Video Display Terminal Committee
Saskatchewan
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Executive Summary

This report is presented by the Saskatchewan Occupational Health and Safety Council to the Honourable Grant Schmidt, Minister of Labour, on the need for regulatory controls on the hazards of video display terminals (VDT's) used in the workplace.

The report recommends controls for the 'documented' hazards which include visual, musculoskeletal, stress and other health related effects and for the 'perceived' hazards which include concerns on radiation emitted from the devices and the concerns of adverse pregnancy outcome among operators.

Recommendations to alleviate visual problems include requiring employers to provide adequate pre-employment and periodic eye examinations and amending the current lighting and glare reduction regulations to better suit VDT work.

Recommendations to alleviate musculoskeletal problems include amending the current seating regulations to include design and adjustability of chair and table as well as enacting new regulations that enable better control of the workstation (positioning of the VDT, availability of leg room and adequate work area for paper work, and availability of suitable document holder).

Recommendations to reduce stress include control of excessive and/or annoying noise arising from the keyboard and the printer, as well as from all sources. The report recommends a sound level of less than 65 dBA from the impact printers and of less than 70 dBA from all other sources. Controls are also recommended for excessive, uncomfortable exposure to heat or to tobacco smoke.

To alleviate other health related effects, the report recommends regulating work breaks and the location of the VDT screen at the workstation in relation to windows and other terminals. A minimum of five minutes non-VDT work break every hour and a 15-minute rest break every two hours have been recommended.

The report acknowledges the lack of conclusive scientific evidence to support a causal relationship between pregnancy outcome and VDT operations. However, it recognizes that a hazard may exist for individual pregnant VDT operators due to individual health conditions, beliefs or the ergonomics of a particular workstation. Therefore, the report recommends urging companies to provide alternate non-VDT work, if available and possible, through

consultation with affected people. If not available or possible, the pregnant VDT operator, who has a legitimate concern, should be allowed to obtain a leave of absence without pay and without loss of seniority for all or parts of the remaining term of pregnancy. Such leave of absence should not limit the operator from obtaining interim employment elsewhere for the duration of the leave and should not affect her entitlement to existing maternity benefits under the federal U.I.C. requirements.

Preface

The introduction of micro computers and computer display terminals into the workplace has been dubbed the silicon revolution. As with the industrial revolution of the 18th and 19th centuries, this has meant significant changes, benefits and problems.

The major change is that many people who previously did their work with a paper and pencil or a typewriter now have computer terminals on their desks. As a result of the introduction of computers into the workplace, businesses now have increased productivity; better control of product and supplies inventories; and better control of financial matters relating to invoicing and account control, due to the speed and volume of information computers can process. As with any introduction of technological change to a workplace, there have also been problems. These problems range from resistance to change to health problems as a result of the change.

Our committee was struck to identify the occupational health and safety hazards that have arisen as a result of the introduction of the video display terminal into the workplace in the past decade; and to recommend regulations which will minimize or eliminate these hazards.

In our discussions, this committee utilized the following definitions:

1. Video Display Terminals are comprised of a typewriter keyboard and a television-like display screen. Information is fed into a computer memory system via the keyboard, and the image appearing on the display screen is generated by a cathode ray tube or an electro luminescence panel.

2. The following VDT workload definitions have been established to provide a basis for the development of this report.

   a) Heavy VDT workloads shall be defined as those workloads requiring more than an average of six (6) hours of VDT operations per workday.

   b) Moderate VDT workloads shall be defined as those workloads requiring more than an average of four (4) and less than six (6) hours of VDT operations per workday.

   c) Light VDT workloads shall be defined as those workloads requiring less than an average of four (4) hours of VDT operations per workday.

Hazards of VDT Use

We have identified two types of hazards: those that have been documented and are known to exist in the workplace; and those that are perceived to exist although they have been proven not to exist or have not yet been adequately documented.

Documented hazards include:

I. Visual problems;

II. Muscle and joint problems (musculoskeletal problems);

III. Stress; and

IV. Combined health effects.

These problems would appear to be associated with physical application and usage of VDT equipment and performance monitoring. Employers can solve the majority of these problems through improved ergonomics.

Perceived hazards include:

I. Radiation, x-rays, low frequency radiowaves;

II. Pregnancy complications - miscarriage and abnormal births.

Part A: Documented Hazards

I. Visual Problems

Visual problems are the concerns most frequently reported by VDT operators. Complaints include eye discomfort, eyestrain, burning, itching, irritation, and aching. Other less frequent symptoms include blurred vision, double vision, color fringes, and reported deterioration of visual acuity. Severe optical discomforts (eye irritation, soreness and tiredness) may not go away within a short period of time following work and may even be present at the start of the next day's shift. Data suggests that some types of VDT work produce greater levels of visual complaints than traditional office or visually demanding inside work.

Prolonged attention to visual detail with reduced eye movement in a restricted visual field can cause eyestrain and other problems. In addition, eyestrain is caused by high light levels and glare from outside light sources and/or reflections from surfaces in the office environment. Finally, air temperature and humidity can lead to sore eyes.

Recommendations

1. Eye examinations

   a) Pre-employment eye examinations to identify and correct any potential or actual visual defects which may be aggravated by VDT operation must be conducted by a qualified optometrist or ophthalmologist.

   b) Appropriate periodic eye examinations for VDT operators to ensure detection and correction of any visual defects which may develop with age.

   c) Committee members felt that the cost of eye examinations would be at the employer's expense as are medicals which are currently required under the mines regulations. He also felt that, with the trend to 4-day work weeks and floating work schedules, most employees would be able to have an examination without needing time off from work. Therefore, we have not recommended that employees be compensated for time to have examinations unless their work location or hours of work are such that it cannot be scheduled without lost time. Committee members also felt that employees have a responsibility for their personal health.

2. Lighting

   Lighting conditions are a very important factor in safe and healthful utilization of a VDT. Proper lighting can be extremely useful in eliminating eyestrain or eyesight deterioration. Proper lighting in VDT rooms will be such that it allows ample light by which to read any hard copy material the operator may be required to utilize; and directed in such a manner that it does not produce a glare upon the screen of the VDT unit.

   Current occupational health regulations[1] cover workplace lighting as follows:

   > "Section 34.--(1) Every employer shall provide, while workers are present, lighting sufficient and suitable for the work to be done in every part of a place of employment.
   >
   > (2) Every employer shall ensure that the illumination of all parts of a place of employment where workers pass, other than underground at a mine, is at least 50 lux.

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1. The Occupational Health and General Regulations, 1981, under The Occupational Health and Safety Act, S. 13.

(3) Where failure of the regular lighting system would be likely to create conditions dangerous to the health or safety of workers, the employer shall provide appropriate emergency lighting of at least 50 lux for the work area and exit routes from the work area.

Section 35. Every employer shall ensure that:

(a) all windows and skylights that provide light to work are, so far as is practicable, kept clean and free from obstruction, but this clause is not to be construed so as to prevent special treatment of windows or skylights for the purpose of reducing heat or glare; and

(b) any artificial light source or reflective surface is positioned, screened or provided with a shade to prevent, so far as is practicable, glare or the formation of shadows that causes discomfort or a risk of accident to any workers."

These two sections of the regulations provide a general requirement for lighting and glare reduction. However, they do not provide any specific lighting standard for the use of VDT's. In view of this, our committee feels the Occupational Health and Safety Branch should develop a regulatory tool similar to the state of New Mexico Executive Order of March, 1985.

1. "Room lighting shall be maintained at a level that reduces eyestrain and glare.

   Generally room lighting should be dimmer than ordinary illumination and should neither be less than 500 lux nor more than 700 lux as measured at the multiple use (ie. use of the VDT and paper copy) workstation. Room lighting should neither be less than 300 nor more than 500 lux as measured at the workstation where users only view VDTs. These levels may need to be adjusted for specific VDT operations or other workstation considerations."[1]

2. Directional lamps for hard copy shall be provided at operator's request where both the VDT and paper copy are necessary for normal work activities.

3. Effective glare control can be maintained through one or more of the following measures:

   - use recessed, indirect and baffled lighting;
   - provide windows with curtains or blinds;
   - design workstations to allow VDT orientation to avoid harsh light sources;

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1. State of New Mexico Executive Order Covering Use of Video Display Terminals by State Employees, Executive Order No. 85-11 by Governor of New Mexico dated the 27th day of March, 1985.

- if a workstation is located near a window, place the VDT at a right angle to the window;
- locate the operator so that light comes from the side or behind the operator to avoid shining directly onto the screen and into the operator's eyes;
- provide screen hoods at operator's request to block angular reflections and glare sources;
- provide detachable anti-glare filters at operator's request;
- use full spectrum lighting;
- use furnishings with a matte, non-reflective finish;
- paint walls in a matte, non-reflective coating.

II. Musculoskeletal Issues

Musculoskeltal problems are common to many sedentary jobs. Because the body is designed for movement, a fixed position is more tiring than a dynamic one. VDT operator complaints are most often related to the neck, shoulders, back and wrists. Complaints mentioned less often involve the arms, hands, and legs. Researchers indicate musculoskeletal symptoms are more frequently reported by VDT operators than workers in traditional office jobs.

According to scientific and medical information, serious musculoskeletal health symptoms are most often associated with VDT jobs requiring constrained working positions for an entire work shift. In a seated position, the VDT operator is subject to continuous stress on almost all postural muscles. The amount of stress is dependent upon the position of various parts of the operator's body. Holding the head to the side or forward may lead to neck and shoulder fatigue and pain. Other neck and shoulder complaints result from the use or position of the operator's arms. For example, the elevation of the arms will add to neck and shoulder strain. Prolonged constrained postures required by the job will make this condition worse.

There are several common characteristics of VDT jobs that have been related to increased musculoskeletal complaints. These include the design of the VDT and workstation equipment, the nature of the task, work place, repetitiveness of the job, work and rest break schedules, and personal attributes of workers. All of these factors must be addressed to effectively reduce postural complaints.

Recommendations

Our investigation revealed that the ergonomics of the usage of VDT's is one of the most important means of eliminating health problems related to VDT's. Proper seating, and adjustable table or desk tops and VDT equipment can eliminate many of the musculoskeletal problems associated with VDT operation. Current occupational health and safety regulations under section 42, subsection (2)[1] regulate seating as follows:

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1. Op. cit.

"Where a substantial portion of any work can properly be done sitting, the employer shall provide and maintain:

a) a seat suitably designed, constructed, dimensioned and supported for the worker to do the work; and

b) where needed, a footrest which can readily and comfortably support the feet."

Councillors would like this section expanded to include adjustability of chairs, table height, VDT screen adjustability and keyboard detachment and adjustability similar to the guidelines included in the Branch's guidelines on VDT usage.[2] Any regulation on adjustability should be broad enough to accommodate variations in physical stature that occur among individuals and should be similar to regulations passed in the state of New Mexico Executive Order as follows:

... "Display screens shall be placed at a height appropriate to and determined by the operator. The top of the screen shall be no higher than operator eye level and the bottom of the screen not lower than forty degrees below the operator's eye level. Operator distance from the screen shall be a matter of operator preference ...

... "The keyboard shall be placed so that the upper arm can hang vertically and the forearm/wrist shall be parallel to the floor ...

... "Chairs shall be flexible and easily adjustable.

- All chairs shall be easily adjustable for seat and backrest height;
- backrests shall have sufficient tension to provide adequate lumbar support;
- backrests shall allow for the operator to lean back to a comfortable resting position;
- seats shall be gently rounded on the front to avoid interference with blood flow to the lower legs;
- all chairs shall be provided with casters to provide ease of glide without hazard.

"Poor chair design can be one of the most significant causes of musculoskeletal stresses and strains. Therefore, agencies shall make every effort within budgetary constraints to comply with this provision as follows -- within one year of the issuance of this Executive Order for heavy users; within two years for moderate users; and within three years for light users...

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2. "Video Display Terminals", Saskatchewan Labour, Occupational Health and Safety Branch, July, 1983.

... "Tables shall be adjustable when needed for proper screen and keyboard heights and adequate leg-room. Where appropriate, proper screen and keyboard heights may be accomplished by using pads...

... "Footrests should be provided at operator's request to ensure that the operator's thighs are parallel to the floor. Improper seat height and design can cut off blood circulation...

... "Document holders should be provided and should be adjustable to the height, distance and angle of the screen to avoid possible glare and unnecessary operator movement which can cause neck, shoulder or backaches...

... "Furniture should be arranged to provide an adequate amount of leg-room to allow freedom of motion...

... "An adequate work area for paper work, etc., should be provided on one side of the VDT. The side this work area will be on shall be determined by the operator."

III. Stress

Job stress as reported by VDT operators is often described in terms of psychological and physical strains such as frustration, anxiety, irritability, anger, depression, stomach or gastro-intestinal disturbances, muscle and psychological tension. As is true with visual and musculoskeletal health complaints, the primary cause of job stress is lack of consideration of the relationship between the worker and the work environment, including eyestrain and musculoskeletal problems. Some of the factors which can contribute to job stress include poor working conditions, excessive noise, excessive job demands and work pace, lack of job control and lack of participation in the implementation of VDT use.

Recommendations

In order to alleviate stress, attention shall be addressed to those areas which contribute to stressful conditions.

1. Excessive and/or annoying noise creates stress which can have an adverse effect upon workers' health, safety and productivity.

   - Acoustic pads shall be installed under keyboards and printers at operator's request.
   - Impact printers shall be provided with acoustic covers where necessary to reduce sound levels to 65 dBA as measured at the workstations.
   - All other noise sources in the surrounding environment should be controlled to ensure that the total sound level measured at the workstation does not exceed 70 dBA.

2. Because of the heat generated by VDT's and other concerns which affect stress, the following are recommended:

   - Every effort shall be made to locate workstations at a reasonable distance from heating and cooling vents. Vents shall be ducted or shielded to divert airflow away from VDT operators.

   - Because of the heat generated by some machines and the effect of heat on eyestrain and working conditions, office temperatures shall be kept between 68 and 74 degrees F (+20 and 23.5°C).

   - Because tobacco smoke affects eyestrain, working conditions, and the functioning of some machines, smoking shall only be permitted in the VDT operations area with the explicit approval of the operator(s).

IV. Combined Health Effects

Prolonged and continuous use of VDT's affects stress level, eyestrain and musculoskeletal problems. Occasional changes in any work will provide an opportunity to flex the body, adjust eyes to different sight conditions, and relieve the tedium of repetitious work. Breaks, therefore, alleviate or prevent visual, muscular and psychological fatigue and may improve overall performance.

Recommendations

1. Work breaks

   Our committee recommends that regulations be established to limit continuous operation of VDT's to a maximum of one hour and that operators be given a break of non-VDT work of a minimum of five minutes after one hour operation.

   We also recommend that workers be allowed a 15 minute rest break during every two hours of VDT work, thereby creating a total of 20 minutes of non-VDT time every two hours.

   For many operators this will not change from their present situation of work breaks and coffee breaks. However, for some very intensive operations (like some Crown Corporations and companies in the province), it will be an improvement over the present system of a 15 minute break after two hours. This recommendation does not go as far as National Institute for Occupational Safety and Health in the United States which recommends a 15 minute break for every hour for jobs that require more than five hours viewing time, as we felt that could be too disruptive to the office routine. Committee members felt that the five minute break was necessary to enable operators to move about and change eye focus, thereby alleviating eye strain and musculoskeletal problems.

2. Workstation location

The ideal location of a VDT screen is a position that is perpendicular to a window as this will minimuze the glare on the screen from window light. Our committee, therefore, recommends that VDT workstations be constructed and located in a manner that will allow positioning of a screen at 90 degrees to any window. We would also recommend that draperies on windows be glare reducing, but not impermeable to light.

We also recommend that work stations not be located in tandem (operator of one station seated directly in front of the back of a VDT located behind him) as the greatest radiation hazard is from the flyback transformer unless shielded.

Part B: Perceived Hazards

I. Radiation

Although testing has shown that the ionizing radiation exposure of operators from VDT units is less than the background radiation level from cosmic radiation and building materials, there is still some concern among operators about radiation, including x-rays and low frequency radio waves from the flyback transformer.

Evidence has been presented to our committee which indicates no x-ray emissions are present with mono-chrome terminals and the emission levels from color terminals are below current standards as defined by regulations promulgated under the Federal Radiation Emitting Devices Act of 1969-70.[1] In most models the flyback transformer is shielded in a manner which prevents the emission of low frequency radio waves. However, in those models which are not adequately shielded, the possibility of low frequency radio emissions does exist and presents the greatest potential hazard to persons located in close proximity to the rear of the terminal. At the present time, there is no consensus on the extent of the hazard associated with low frequency radio wave emissions.

Recommendations

Although it has been demonstrated that there is currently not an x-ray hazard, our committee recommends that the Occupational Health and Safety Branch continue to monitor VDT equipment to ensure that no new models or modifications are introduced which result in emissions exceeding the standard.

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1. Radiation Emitting Devices Regulations (1978) Chapter 1370 promulgated under The Radiation Emitting Devices Act, Chapter 34 (1st supplement), 1969-70. Canada.

II. Pregnancy complications

A perception exists in the workplace and among the general public that VDT usage can have a negative effect upon pregnancy outcome resulting in miscarriage or birth defects. This perception exists for two reasons: 1. due to the high rate of abnormal pregnancy outcomes at 13 workplaces, which are commonly referred to as clusters[2]; and 2. due to the perceived radiation hazard associated with VDT units.

Therefore, we have chosen to include the effect of VDT's upon pregnancy as a perceived hazard. We feel that the health of both an expectant mother and her fetus should be of paramount concern to employers, employees and society and therefore, this concern is not one that should be dismissed lightly. However, in the face of current scientific evidence, we were unable to conclude that a direct cause and effect relationship exists between VDT usage and pregnancy outcome, or that the rate of adverse pregnancy outcome is indeed higher for VDT operators than the general population, other than those included in the publicized clusters.

The clusters of birth defects have been studied or are currently being studied, and published reports and preliminary findings indicate that there is no definite link between VDT operation and pregnancy outcome. This then leaves the question of the occurrence of these clusters being a chance event. Since there is no accurate estimate of the number of VDT installations in use or the number of operators, we were unable to determine if it is statistically possible that these are chance occurrences. Currently, due to the uncertainty that exists with respect to the causal link between VDT operation and pregnancy outcome, many employers have a policy which allows pregnant VDT operators to transfer to alternate non-VDT work or take an extended maternity leave for the total duration of their pregnancy. This practice has been successful in reducing the risk to individual operators, but has also tended to reinforce the perception that VDT operation may be hazardous to pregnancy outcome.

Recommendations

Although our committee considers pregnancy concerns to be of a perceived nature, due to the public's concern being based upon inadequately documented beliefs, we also recognize that due to individual health conditions, beliefs and the ergonomics of a particular workstation, a hazard may exist for individual VDT operators during pregnancy. We also recognize that the perception of risk will vary among individuals. Therefore, we recommend that the following steps be taken with regard to pregnant VDT operators.

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2. Refer to Appendix 1, page 14

a) Individual companies should establish a policy of alternate work if available and possible through consultation with the affected people. Our committee could not recommend making this mandatory under legislation, at this time, as there is no conclusive scientific evidence available to support a causal relationship between pregnancy outcome and VDT operation. Consequently, we are reluctant to call for legislative protection from an unproven potential hazard as it could result in unnecessary expense to firms and could come to be regarded as an employee right in the future, even though it has no scientific basis. Members also believe that improved ergonomic detail in VDT usage and operation will decrease any potential hazard to pregnant VDT operators.

b) If alternate work is not available or possible the pregnant VDT operator, who has a legitimate concern, may obtain a leave of absence without pay and without loss of seniority for all or parts of the remaining term of her pregnancy.

Partial leave is defined as a period of not less than thirty (30) days unless by mutual agreement of the operator and employer.

c) The voluntary leave of absence should not limit the operator from obtaining an interim position elsewhere for the duration of the leave.

d) This committee is of the opinion that the operator's entitlement to existing maternity benefits under the U.I.C. should not be adversely affected by virtue of obtaining a voluntary leave of absence.

Compensation

Recently we have seen proposed legislation that would entitle a pregnant VDT operator to collect Workers' Compensation benefits if unable to find suitable alternate work in her firm. This committee does not support this concept.

Appendix I

Literature and News Media Reported Clusters of Adverse Pregnancy Outcome in VDT Operators

The following table summarizes the publicized clusters of adverse pregnancy outcome in VDT operators. Only the first three clusters have been reported in detail and only the first two have been subjected to a statistical analysis. Some clusters appeared only in the public news media and in specialized news media such as "Microwave News" and "9 to 5 Campaign". Some of the given information, therefore, lacks the desirable preciseness.

Organization	Observation period (years)	Number of pregnancies	Number of adverse outcome (and percentage)*	Types of outcome
Sears-Roebuck Dallas, Texas	3	22	8 (36%)	7 spontaneous abortions 1 neonatal death
Defense Logistic Agency, Atlanta, Georgia	1	15	10 (67%)	7 spontaneous abortions 3 congenital defects (unidentified)
Toronto Star, Toronto, Ontario	1	7	4 (57%)	1 clubfoot 1 cleft palate 1 eye abnormality 1 heart abnormality
Solicitor General's Office, Ottawa	3	8	7 (88%)	4 spontaneous abortions 1 premature birth 2 respiratory problems
Air Canada, Dorval Airport, Montreal, Quebec	3	13	7 (53%)	7 spontaneous abortions
Attorney General's Office, Toronto, Ontario	3	27	13 (48%)	12 spontaneous abortions 1 disconnected oesophagus
Pacific Northwest Bell, Renton, Washington	2.5	5	3 (60%)	1 neonatal death 1 Down's Syndrome 1 spina bifida
Surrey Memorial Hospital, Vancouver, B.C.	4.5	7	6 (86%)	3 spontaneous abortions 2 congenital defects 1 premature birth

(continued)

Organization	Observation period (years)	Number of pregnancies (continued)	Number of adverse outcome (and percentage)*	Types of outcome
Other less known clusters:				
Alma, Michigan	?	32	17 (53%)	?
Atlanta, Georgia	?	15	6 (40%)	?
Great Neck, New York	?	?	6 (?)	?
San Francisco, Cal.	?	48	19 (40%)	?
Gander, Newfoundland	?	31	3 (10%)	?

Sources: Purdham, J. Adverse Pregnancy Outcome Amongst VDT Operators - The Cluster Phenomenon. Papers presented at an International Meeting to Examine the Allegations of Reproductive Hazards from VDU's, London 29 and 30 November, 1984.

Bergquist, Ulf OV. Video Display Terminals and Health, A Technical and Medical Appraisal of the State of the Art. Scan. J. Work, Environ. Health, 10, Suppl. 2, 1984.

*Background rates: 15% for spontaneous abortions
3% for serious congenital defects
6-12% for less serious diverse malformations
5- 8% for prematurity (by weight or by duration of gestation)

Source: Alison D. McDonald, Epidemiology of Spontaneous Abortions, Birth Defects and Prematurity, London Meeting, 1984.